

GTFS-realtime Reference for the New York City Subway

This document defines how the GTFS-realtime feed is implemented by the New York City Transit Subway. Elements not specified below are not used in the NYC Subway feed. At the generation of this specification the initial data suite will include the number 1, 2, 3, 4, 5, and 6 lines along with the Grand Central Shuttle.

Refer to the GTFS-realtime specification at <https://developers.google.com/transit/gtfs-realtime/> for more details on message field type, cardinality, etc. This document outlines only the NYCT subway specific usage and extensions.

This document also contains extensions added specifically for NYCT (NyctFeedHeader, NyctTripDescriptor and NyctStopTimeUpdate). To use these extensions, you need the nyct-subway.proto file (URL TBD).

This is the specification for version 1.1.

message FeedMessage

The feed is a full dataset and contains two kinds of entities: trip updates and alerts. The feed is generated every 30 seconds.

Fields

<i>Field Name</i>	<i>NYC Subway Usage</i>
header	As defined in the GTFS-realtime Specification
entity	Repeated TripUpdate and Alert messages.

message FeedHeader

The feed is a full dataset and contains two kinds of entities: trip updates and alerts.

Fields

<i>Field Name</i>	<i>NYC Subway Usage</i>
gtfs_realtime_version	1.0
incrementally	FULL_DATASET
timestamp	As defined in the GTFS-realtime Specification

Extensions

<i>Field Name</i>	<i>Type</i>	<i>Cardinality</i>	<i>NYC Subway Usage</i>
nyct_feed_header	NyctFeedHeader	optional	NYC subway specific feed header information.

message NyctFeedHeader

This message is an extension to the FeedHeader containing the version of the NYCT extensions and information on how feed consumers should interpret trip updates in the NYC subway feed.

For the NYCT Subway, the GTFS-realtime feed replaces any scheduled trip within the `trip_replacement_period`.

This feed is a full dataset, it contains all trips starting in the `trip_replacement_period`. If a trip from the static GTFS is not found in the GTFS-realtime feed, it should be considered as cancelled.

The replacement period can be different for each route, so we supply a list of the routes where the trips in the feed replace all scheduled trips within the replacement period. This is 30 minutes for all routes currently implemented.

Fields

<i>Field Name</i>	<i>Type</i>	<i>Cardinality</i>	<i>NYC Subway Usage</i>
nyct_subway_version	string	required	Version of the NYCT Subway extensions The current version is 1.0
trip_replacement_period	TripReplacementPeriod	repeated	Trip replacement period for each route in the feed.

message TripReplacementPeriod

The TripReplacementPeriod defines the trip replacement period for each route in the system.

Fields

<i>Field Name</i>	<i>Type</i>	<i>Cardinality</i>	<i>NYC Subway Usage</i>
route_id	string	optional	Route ID used as in transit_realtime.TripDescriptor.route_id
replacement_period	TimeRange	optional	The start time is omitted, the end time is currently now + 30 minutes for all routes of the A division. See transit_realtime.TimeRange.

message FeedEntity

As currently configured the feed entity will be either be a trip update, vehicle position or an alert.

Fields

<i>Field Name</i>	<i>NYC Subway Usage</i>
id	As defined in the GTFS-realtime Specification
is_deleted	Not used.
trip_update	See TripUpdate message.
vehicle	See VehiclePosition message
alert	See Alert message.

message TripUpdate

The NYC subway trip updates includes the 1, 2, 3, 4, 5, 6 lines and the Grand Central Shuttle (the A division, IRT).

The feed contains **all** revenue trips that are either:

- already underway (assigned trips), or
- scheduled to start in the next 30 minutes (unassigned trips)

Trips are usually assigned to a physical train a few minutes before the scheduled start time, sometimes just a few seconds before.

If a trip is included in the GTFS-realtime feed, there is a high probability that it will depart from its originating terminal as planned. It is more likely that a train that is never assigned a trip identifier to be changed or cancelled than an assigned one.

*Train Assignment is a function of the Automatic Train Supervision (ATS) office system used by NYCT Rail Operations to monitor and track train movements. ATS provides the ability to "assign" the **nyct_train_id** attribute when a physical train is at its origin terminal. These assigned trips have the **is_assigned** field set in the TripDescriptor.*

*When a train is at a terminal but has not been given a work program it is declared unassigned and is tagged as such. Unassigned trains can be moved to a storage location or assigned a **nyct_train_id** when a determination for service is made.*

Fields

Field Name	NYC Subway Usage
trip	As defined in the GTFS-realtime Specification
vehicle	Not used
stop_time_update	This includes all future Stop Times for the trip but StopTimes from the past are omitted. The first StopTime in the sequence is the stop the train is currently approaching, stopped at or about to leave. A stop is dropped from the sequence when the train departs the station.

message TripDescriptor

The New York City subway is a 24 x 7 operations and as a result is a highly dynamic operation. The majority of repairs and maintenance are performed during live operations so the daily service plan is subject to both planned and unplanned changes. The result of this is that some trips defined in the GTFS trips.txt may change (originating times, trip running times and trip path), cancelled or new trips may be added.

Unfortunately, there is no reliable way for us to determine the relationship between the actual and the static GTFS trip, so we can't tell if a particular trip is the original one or has been changed or added later so the ScheduleRelationship is not used.

While trip_id in the GTFS-realtime feed will not directly match the trip_id in trips.txt, a partial match should be possible if the trip has been defined in trips.txt. If there is a partial match, the trip is a scheduled trip.

For example, if a trip_id in trips.txt is A20111204SAT_021150_2..N08R, the GTFS-realtime trip_id will be 021150_2..N08R which is unique within the day type (WKD, SAT, SUN).

A20111204SAT_021150_2..N08R is decoded as follows:

A – Is the Sub-Division identifier. A identifies Sub-Division A (IRT) which include the GC Shuttle and all number lines with the exception of the 7 line. B identifies Sub-Division B (BMT and IND) which includes the Franklin Ave and Rockaway Shuttles, all letter lines and the 7 line.

20111204 – Effective date of the base schedule, Dec 4, 2011

SAT – Is the applicable service code. Typically it will be WKD-Weekday, SAT-Saturday or SUN-Sunday

021150 – This identifies the trips origin time. Times are coded reflecting hundredths of a minute past midnight and converts to (03:31:30 also described as 0331+ where the + equals 30 seconds). This format provides more "precision" than can be realistically attributed to a transit operation, and most applications can safely round or truncate these numbers to the nearest minute. Since Transit authority internal timetables frequently involve half-minute scheduling, systems involved in train control or monitoring will need to represent times in a more accurate manner (to at least the half minute, and perhaps to the tenth minute or one second level). It should be noted that the service associated with a single day's subway schedule is not necessarily confined to a twenty-four hour period. Negative numbers reflect times prior to the day of the schedule (-0000200 refers to 11:58 PM yesterday) and numbers exceeding 00144000 (a day has 1440 minutes) reflect times beyond the day of the schedule (00145000 refers to 12:10 AM tomorrow).

2..N08R – This identifies the Trip Path (stopping pattern) for a unique train trip. This can be decomposed into the Route ID (aka service, **2** train) Direction (**N**orthbound train) and Path Identifier (**08R**). Internally this path provides operations planning such information as origination, destination, all stops, routing scheme (express/local) in Manhattan/Bronx/Brooklyn, operating time periods, and shape (circle = local, diamond = express).

The combination of Origin Time, Route ID and Direction can be used to identify a unique trip. The Path Identifier should be considered optional data that will only be provided when known. This could result with it being there at the start of a trip but not during portions of the trip.

Fields

<i>Field Name</i>	<i>NYC Subway Usage</i>
trip_id	Constructed from the scheduled start time of the trip and a shape_id: <start time>_<shape_id>. The start time is represented as hundredths of minutes past midnight, six digits 0 padded. So, 6:45:30am would be 040550.
route_id	As defined in the GTFS-realtime Specification
start_time	Not used
start_date	As defined in the GTFS-realtime Specification
schedule_relationship	It is our recommendation that the realtime feed train data should replace that of the static train schedule data. There will be times when a link between the schedule trip and the realtime trip may be possible but it is not an absolute. Realtime trip information will be made available approximately 30 minutes before the scheduled origin time.

Extensions

<i>Field Name</i>	<i>Type</i>	<i>Cardinality</i>	<i>NYC Subway Usage</i>
nyct_trip_descriptor	NyctTripDescriptor	optional	NYC subway specific trip descriptor information.

message NyctTripDescriptor

This message is an extension to the TripDescriptor, it contains the NYC subway specific trip information.

Field Name	Type	Cardinality	NYC Subway Usage
is_assigned	Bool	optional	This trip has been assigned to a physical train. If true, this trip is already underway or most likely will depart shortly. See the discussion of the <i>assigned</i> status at TripUpdate for more details.
train_id	String	optional	<p>This field is meant for internal use only. It provides an easy way to associated GTFS-RT trip identifiers with NYCT rail operations identifier</p> <p>The ATS office system assigns unique train identification (Train ID) to each train operating within or ready to enter the mainline of the monitored territory. An example of this is 06 0123+ PEL/BBR and is decoded as follows:</p> <p>The first character represents the trip type designator. 0 identifies a scheduled revenue trip. Other revenue trip values that are a result of a change to the base schedule include; [= reroute], [/ skip stop], [\$ turn train] also known as shortly lined service.</p> <p>The second character 6 represents the trip line i.e. number 6 train</p> <p>The third set of characters identify the decoded origin time. The last character may be blank “on the whole minute” or + “30 seconds”</p> <p><i>Note: Origin times will not change when there is a trip type change.</i></p> <p>This is followed by a three character “Origin Location” / “Destination Location”</p>
direction	Direction	optional	Direction of the train.

enum Direction

The direction the train is moving to. Only NORTH and SOUTH are used.

Values

<i>Value</i>	<i>Comment</i>
NORTH	<ul style="list-style-type: none">• Uptown and Bronx-bound trains.• Times Square Shuttle to Grand Central
EAST	Not used.
SOUTH	<ul style="list-style-type: none">• Downtown and Brooklyn-bound trains• Times Square Shuttle to Times Square
WEST	Not used.

message StopTimeUpdate

For most stops along the trip path, NYC subway schedules define a transit time. Departure times are supplied for the Origin Terminal, arrival times for the Destination Terminal. Transit times are provided at all in-between stops except at those locations where there are “scheduled holds”. At those locations both arrival and departure times are given.

Note that the predicted times are not updated when the train is not moving. Feed consumers can detect this condition using the timestamp in the VehiclePosition message.

Fields

<i>Field Name</i>	<i>NYC Subway Usage</i>
stop_sequence	Not used
stop_id	parent_station (from stops.txt) and the direction the train is moving to ('N' or 'S'). For example, a northbound trip Hunts Point Ave stop is 613N.
arrival	Predicted arrival time when there is a scheduled arrival time, predicted transit time if there is a scheduled transit time, not used otherwise.
departure	Predicted departure time when there is a scheduled departure time, predicted transit time if there is a scheduled transit time, not used otherwise.
schedule_relationship	Not used

Extensions

<i>Field Name</i>	<i>Type</i>	<i>Cardinality</i>	<i>NYC Subway Usage</i>
nyct_stop_time_update	NyctStopTimeUpdate	optional	Extension for NYC subway specific stop time update information.

message NyctStopTimeUpdate

This message is an extension to StopTimeUpdate to accommodate NYC subway specific information.

Field Name	Type	Cardinality	NYC Subway Usage
scheduled_track	String	optional	<p>This is an NYCT Subway extension. It provides the scheduled station arrival track. This may change enroute during automated rerouting operations. The following is the Manhattan track configurations:</p> <ul style="list-style-type: none"> 1: southbound local 2: southbound express 3: northbound express 4: northbound local <p>In the Bronx (except Dyre Ave line)</p> <ul style="list-style-type: none"> M: bi-directional express (in the AM express to Manhattan, in the PM express away). <p>The Dyre Ave line is configured:</p> <ul style="list-style-type: none"> 1: southbound 2: northbound 3: bi-directional
actual_track	String	Optional	<p>This is the actual track that the train is operating on and can be used to determine if a train is operating according to its current schedule (plan).</p> <p>The actual track is not known before the train leaves the previous station. Therefore, the NYCT feed sets this field only for the first station of the remaining trip.</p>

Usage notes: For a train enroute, the actual track may differ from the scheduled track. This could be the result of manually rerouting the train from its scheduled track. When this occurs, prediction data may become unreliable since the train is no longer operating in accordance to its schedule. The rules engine for the “countdown” clocks will remove this train from all scheduled station signage. It is highly probable that the train will be rerouted back to its schedule track at some future point. When this happens train prediction for this train will return to the “countdown” clocks.

It is not unusual for the schedule/actual track numbers to differ at the origin and destination terminals.

message StopTimeEvent

Fields

<i>Field Name</i>	<i>NYC Subway Usage</i>
delay	Not used
time	As defined in the GTFS-realtime Specification
uncertainty	Not used

message VehiclePosition

A VehiclePosition entity is provided for every trip when it starts moving. Note that a train can be assigned (see TripUpdate) but has not started to move (e.g. a train waiting to leave the origin station), therefore, no VehiclePosition is provided.

Usage notes:

The motivation to include VehiclePosition is to provide the timestamp field. This is the time of the last detected movement of the train. This allows feed consumers to detect the situation when a train stops moving (aka stalled). The platform countdown clocks only count down when trains are moving otherwise they persist the last published arrival time for that train. If one wants to mimic this behavior you must first determine the absence of movement (stalled train condition) , then the countdown must be stopped.

As an example, a countdown could be stopped for a trip when the difference between the timestamp in the VehiclePosition and the timestamp in the field header is greater than, 90 seconds.

Note: since VehiclePosition information is not provided until the train starts moving, it is recommended that feed consumers use the origin terminal departure to determine a train stalled condition.

Fields

<i>Field Name</i>	<i>NYC Subway Usage</i>
trip	See TripDescriptor
vehicle	Not used
position	Not used
current_stop_sequence	As defined in the GTFS-realtime Specification
stop_id	See StopTimeUpdate
current_status	As defined in the GTFS-realtime Specification
timestamp	As defined in the GTFS-realtime Specification
congestion_level	Not used

message Alert

The only alerts included in the NYCT Subway GTFS-realtime feed are notifications about delayed trains therefore the entity is always a trip. In general, when a train is shown as 'delayed' on the station countdown clocks, an Alert is generated for that trip in the feed.

Fields

<i>Field Name</i>	<i>NYC Subway Usage</i>
active_period	Not used.
informed_entity	One or more TripDescriptors, see EntitySelector.
cause	Not used.
effect	Not used.
url	Not used.
header_text	A TranslatedString with one translation with the text 'Train delayed', language unspecified.
description_text	Not used.

message EntitySelector

Alerts are always for trips, so entities are TripDescriptors.

Fields

<i>Field Name</i>	<i>NYC Subway Usage</i>
agency_id	Not used.
route_id	Not used.
trip	See TripDescriptor
stop_id	Not used.